



Sedentary behaviour



BHF National Centre
physical activity+health

Funded by



Contents

Summary	1
Introduction	1
What is sedentary behaviour?	2
Physical and psychological health outcomes of sedentary behaviour	3
Current levels of sedentary behaviour	5
Factors influencing sedentary behaviour	7
Public health guidelines	8
Interventions to reduce sedentary behaviour	8
Implications for practice	9

The purpose of this evidence briefing is to provide an overview of the evidence relating to sedentary behaviour and public health to help commissioners, policy makers and practitioners influence work in this field. It defines sedentary behaviour and summarises the risks, current levels and the factors influencing this behaviour as well as the current evidence for effectiveness of interventions to reduce sedentary behaviour. The new UK Chief Medical Officers' physical activity guidelines for sedentary behaviour and the implications for policy and practice are highlighted.

Summary

The evidence reviewed in this document indicates:

- Sedentary behaviour (behaviour such as sitting and lying) is not defined simply as a lack of physical activity ('inactivity') but is a separate behaviour in its own right.
- Sedentary behaviours can occur in all age groups at work and school, during leisure-time and whilst using motorised transport.
- Sedentary behaviour may be adversely associated with chronic disease in adults and risk factors for chronic disease in children and adolescents.
- Even individuals who currently meet recommended levels of physical activity may be susceptible to the adverse effects of prolonged bouts of sedentary behaviour.
- Patterns of sedentary behaviour established during childhood persist at a moderate level throughout childhood and adolescence.
- Levels of sedentary behaviour typically increase with age.
- Family- and home-related factors are an important influence on sedentary behaviour during childhood.
- Public health guidelines recommend that people of all ages should avoid prolonged periods of sedentary behaviour.
- Interventions to reduce sedentary behaviour in children have generally been successful. However, the effects are small and the characteristics of successful interventions are unclear.
- More research is needed to identify effective methods of reducing sedentary behaviour in adults.

Introduction

For the majority of our evolutionary history humans lived a hunter gatherer existence which required high levels of physical activity to acquire food and water, obtain shelter and avoid predators. Over time, advances in technology and agriculture gradually reduced the energy expenditure required to fulfil these survival needs^(1, 2). Today, in many developed countries, large segments of the population now spend a significant proportion of their day sitting and using labour-saving devices.

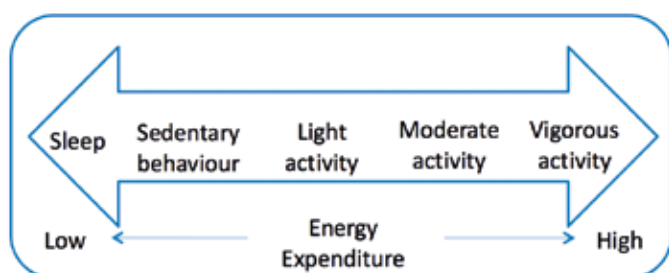
The benefits of a physically active lifestyle for morbidity and mortality are well established and reflected in public health guidelines and policy⁽³⁾. In recent years, however, there has been growing interest in the role that sedentary behaviour may play in health and wellbeing. Informed by this emerging body of evidence, public health guidelines now recommend that people of all ages should avoid prolonged periods of sedentary behaviour and break up periods of sitting⁽³⁾.



What is sedentary behaviour?

Sedentary behaviour refers to a group of behaviours that occur whilst sitting or lying down while awake and typically require very low energy expenditure⁽⁴⁾. The low energy requirements distinguish sedentary behaviours from other behaviours that also occur whilst seated but require greater effort and energy expenditure, eg, using a rowing machine. The position of sedentary behaviour on the energy expenditure continuum, and in relation to sleep and physical activity, is presented in Figure 1 (adapted from⁽⁵⁾).

Figure 1. Human movement and energy expenditure continuum.



Sedentary behaviour is not defined simply as a lack of physical activity but is a separate behaviour in its own right. It is possible for individuals to participate in the recommended amount of physical activity and also engage in high levels of sedentary behaviour. Moreover, the health outcomes of sedentary behaviour have often been identified independent of participation in physical activity. It would be inaccurate to surmise that an individual is 'sedentary' based solely upon data indicating that they are not sufficiently active or that an individual who does not meet the guideline amount of physical activity spends their entire time sitting⁽³⁾.

Examples of sedentary behaviour

In many industrialised societies, occupational sitting represents the major source of sedentary behaviour in adults. Children may accumulate substantial sedentary time whilst at school, eg, during lessons. During leisure-time, common sedentary behaviours include watching television, using a computer or playing video games (excluding 'active' gaming), reading and sitting whilst socialising with friends or family. Sedentary time may also be accumulated whilst using motorised transport, particularly door-to-door transport in a car.

For the purpose of this evidence briefing, the population is divided into two groups: children and young people (which includes early years, ie, children under the age of 5 and children and young people aged 5 to 16) and adults (which includes adults aged 17 to 64 and older adults, aged 65+).



Physical and psychological health outcomes of sedentary behaviour

Since the late 1990s there has been rapid growth in research exploring the association of sedentary behaviour with various health outcomes. Here we summarise the evidence linking sedentary behaviour with physical and psychological wellbeing in adults and children and young people ⁽⁵⁻⁸⁾.

Adults

Recent reviews of the literature, focusing on prospective studies, have found consistent evidence that sedentary behaviour:

- is associated with an increased risk of type 2 diabetes, cardiovascular disease and death from all causes ^(6, 7, 9)
- may increase risk of certain types of cancer, but findings are somewhat inconsistent ^(6, 9, 10).

Despite being widely studied, the association of sedentary behaviour with overweight/obesity or weight gain remains plausible yet unproven. Accordingly, more research is required to either support or refute an association between sedentary behaviour and weight status as well as cancer. A small number of studies have reported that sedentary behaviour may be adversely associated with psychological health, eg, depression and mental wellbeing, but more research is needed ^(11, 12).

Key term - prospective/longitudinal study

Prospective studies, also known as cohort or longitudinal studies, examine the development of disease (or other health outcome) by measuring a risk factor at the beginning of the study (baseline) and then following participants over time to assess who does and does not develop disease. These studies provide stronger evidence that a risk factor may be causally associated with disease compared to cross-sectional ('snapshot') studies which measure both risk factor and disease status at the same point in time.

Children and young people

The association of TV viewing and computer use with weight status in children and young people has been studied extensively. Previous reviews of the literature have reported that TV and computer use are adversely associated with weight status, but the association is small ⁽¹³⁾. A more recent review summarising only prospective studies reported mixed evidence linking TV and computer use with weight status ⁽⁸⁾. In contrast, a second review found positive associations between screen time and the consumption of energy dense food ⁽¹⁴⁾. The evidence on this issue, therefore, remains uncertain and is subject to on-going debate.

High quality research exploring the association of sedentary behaviour with other physical and psychological health outcomes in children and young people is lacking. There however, is some evidence that sedentary behaviour is associated with lower levels of aerobic fitness ⁽⁸⁾ and adverse cardiovascular disease risk factor profiles ⁽¹⁵⁾.

Evidence to inform recommendations for sedentary behaviour

The health outcomes associated with sedentary behaviour in children, young people and adults remains a relatively new field of study, with a much smaller evidence base than that accumulated for physical activity and health outcomes. Most studies to date have focused solely upon the health outcomes associated with TV viewing while the health outcomes of other forms of sedentary behaviour, for example, occupational sitting or 'total' sedentary time, are less clear. For these reasons, it is currently not possible to provide an evidence-based quantitative recommendation, eg, <2 hours/day of sitting, for reducing the health risks of sedentary behaviour.

Persistence of sedentary behaviour over time

It is possible that high levels of sedentary behaviour sustained over many years may present a health risk that exceeds the risks associated with sedentary behaviour over shorter duration. A recent review indicated TV viewing, computer and video game use and total sedentary time track at a 'moderate' level during childhood and adolescence, indicating that



patterns of sedentary behaviour established during childhood are relatively stable over time. These findings suggest efforts to reduce sedentary behaviour should begin during childhood and adolescence ⁽¹⁶⁾.

Key term - track/tracking

The degree to which sedentary behaviour patterns persist over time is known as tracking. High levels of tracking indicate patterns are stable over time. An example of 'good' or 'high' levels of tracking would be a child who engages in high quantities of sedentary behaviour at age 10 and continues to do so at age 15 and beyond.

Summary

- There is a growing body of evidence linking sedentary behaviour with chronic disease morbidity and mortality in adults and preliminary evidence to suggest sedentary behaviour may also be a health risk in children and young people.
- The evidence is currently limited by a predominant focus on TV viewing or screen time and lacks high quality prospective and experimental research.

- Existing literature indicates sedentary behaviour patterns appear to be relatively stable over time during childhood and adolescence, indicating programmes aimed at reducing sedentary behaviour should begin during childhood.
- Many of the potential health outcomes associated with sedentary behaviour, in both children and adults, have been found to be independent of physical activity. That is, even individuals who currently meet recommended levels of physical activity may be susceptible to the adverse effects of prolonged bouts of sedentary behaviour.

Key term - experimental study

Experimental studies seek to determine the cause and effect relationship between a specific intervention and a predetermined outcome. In this approach, the researcher identifies two sets of variables; one set is manipulated while the other is used for measuring the changes or outcomes. Experimental studies have a pre-post-test design, a treatment and control group and random assignment of study participants.



Current levels of sedentary behaviour

In this section we summarise findings from the available surveillance studies in the four home countries (England, Scotland, Wales and Northern Ireland), where available, describing levels of sedentary behaviour in adults and children. As noted previously, much of existing research has focused solely upon TV viewing or other screen-based behaviours. More data are required in both children and adults to establish total daily sedentary behaviour and time spent in other domains of sedentary behaviour, eg, occupational/school and transport-related sitting time.

Adults

England

- Total daily sedentary time increased with age (Figure 2).
- Adults on average watched 2.8 hours of TV on weekdays and 3.2 (men) and 3.0 (women) hours per day at the weekend.
- Daily TV viewing time increased with age in both men and women from approximately 2.5 hours per day for those aged 16-24 up to almost 4 hours per day in those aged 75+ years ⁽¹⁷⁾.

Scotland

- The average time adults spent on TV viewing and other screen-based entertainment was 3.6 (men) and 3.2 (women) hours per day (Figure 3) ⁽¹⁸⁾.

Northern Ireland and Wales

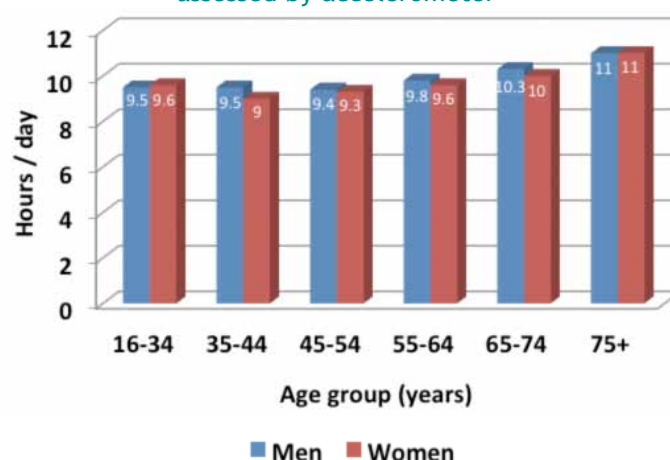
- No data is currently available for Northern Ireland and Wales.

Children and young people

England

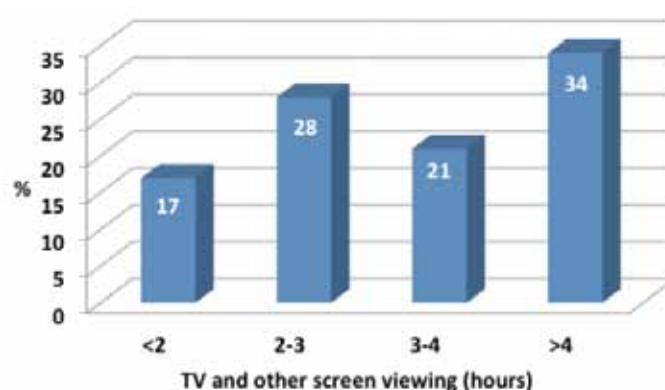
- Total daily sedentary time, assessed by accelerometer, increased with age from 6-7 hours per day at age 4-7 years to 8-9 hours per day at age 12-15.
- In general, daily TV viewing increased with age (Figure 4) ⁽¹⁷⁾.
- 41% of boys and 13% of girls reported more than 2 hours of game playing (on a computer or games console) per day ⁽¹⁹⁾.

Figure 2. Total sedentary time in English adults, assessed by accelerometer



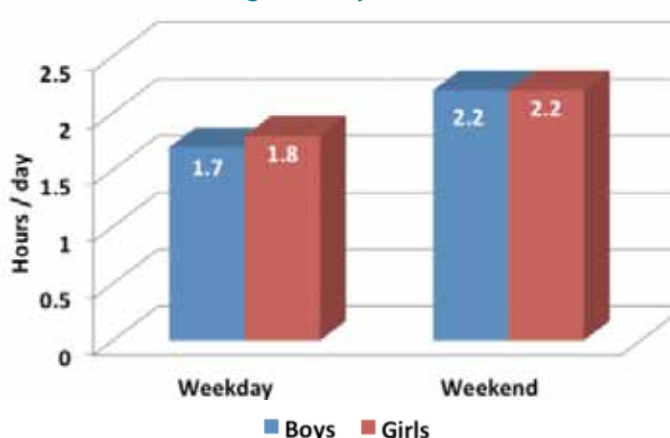
Data Source: Health Survey for England 2008

Figure 3. Daily TV and other screen-viewing in Scottish adults



Data Source: The Scottish Health Survey 2003

Figure 4. TV viewing in English children aged 2-15 years



Data Source: Health Survey for England 2008

Scotland

- 50% of boys and 19% of girls reported more than 2 hours of game playing (on a computer or games console) per day ⁽¹⁹⁾.
- Among children aged approximately 4 years, 33% watched less than 60 minutes of TV per day and 30% exceeded 2 hours per day ⁽²⁰⁾.
- On weekdays, 62% of boys and 57% of girls aged 11 years exceeded 2 hours per day of TV viewing. These figures increased to 69% (boys) and 68% (girls) at age 15 years ⁽²¹⁾.
- Additionally, 53% of boys and 29% of girls aged 11 years reported greater than 2 hours of computer game play (weekdays). At age 15 these figures increased to 64% in boys but decreased to 26% in girls ⁽²¹⁾.

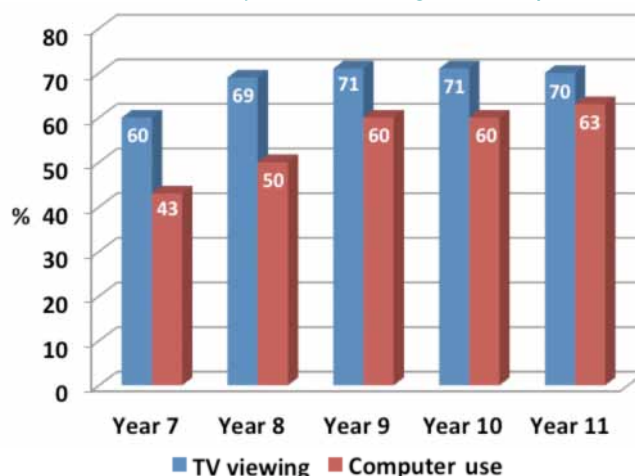
Wales

- In 2005/2006, 43% of boys and 19% of girls reported more than 2 hours of game playing (on a computer or games console) per day ⁽¹⁹⁾.
- Overall, 67% of girls and 70% of boys aged 11-16 years reported greater than 2 hours per day of TV viewing on weekdays ⁽²²⁾.
- 61% of girls and 51% of boys aged 11-16 reported 2 hours or more of computer use (playing games and internet use) on weekdays ⁽²²⁾.
- The proportion of respondents exceeding 2 hours per day of TV viewing and computer use increased with age (Figure 5) ⁽²²⁾.

Northern Ireland

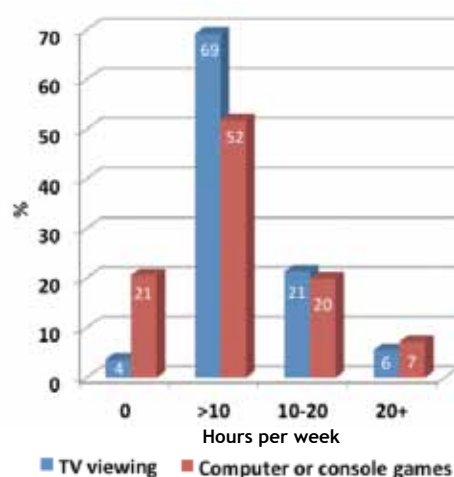
The largest proportion of young people in Northern Ireland, age 11-16 years, reported using the TV or computer/console games for less than 10 hours per week (Figure 6) ⁽²³⁾.

Figure 5. Proportion of Welsh children exceeding two hours/day of TV viewing and computer use



Data Source: Health Behaviour in School Aged Children 2009/2010

Figure 6. Hours of use per week in young people in Northern Ireland



Data Source: Northern Ireland's Young Persons' Behaviour & Attitudes Survey 2010

Factors influencing sedentary behaviour

A key step in the development of programmes aimed at reducing sedentary behaviour is to identify factors (correlates) associated with participation in sedentary behaviour⁽²⁴⁾. Research into the correlates of sedentary behaviour is emerging, but the majority of studies to date have focused solely upon TV viewing or other screen-based behaviours. Below, we summarise the evidence for sedentary behaviour correlates in adults and children and young people.

Key term - correlates

Correlates are factors that influence behaviour. Correlates may be fixed or non-modifiable, eg, sex, ethnicity, age, which are useful for identifying population groups that should be targeted in intervention programmes. Alternatively, correlates may be modifiable, for example, social support, attitudes, or parental rules, wherein intervention strategies may be developed to change these factors potentially leading to changes in behaviour.

Adults

There is currently a lack of research exploring the correlates of sedentary behaviour in adults. While more research is needed to identify modifiable correlates of sedentary behaviour in adults, the evidence we have related to sedentary behaviour is:

Biological factors

- Age: In general, sedentary behaviour increases with age, with evidence of a marked increase from approximately 60 years of age onwards⁽²⁵⁾.
- Gender: Whether men or women are more sedentary appears to differ according to the particular age range under study. Up to the age of 40 years, women appear to engage in higher levels of sedentary behaviour, whilst in those aged 60 years and above levels of sedentary behaviour appear to be greater among men⁽²⁵⁾.

Demographic factors

- Socio-economic status (SES): Consistent with findings from other countries, data from the Scottish Health Survey indicate screen-based sedentary behaviour is greatest in low (SES) groups⁽¹⁸⁾.

There is currently no evidence on social, cultural and environmental factors and associations with sedentary behaviour in adults.

Children and young people

This summary is based upon recent reviews of the literature⁽²⁶⁻³²⁾:

Biological factors

- Age: Sedentary behaviour increases during childhood and from childhood into adolescence.
- Gender: In young children (less than ten years), TV viewing and computer use do not appear to differ between boys and girls. During adolescence, there is some evidence to suggest boys typically spend more time than girls watching TV or using a computer (especially playing computer games).

Demographic factors

- Socio-economic status: Markers of SES, such as parental income or education, are inversely associated with sedentary behaviour (ie, sedentary behaviour tends to be higher in low SES groups).
- Ethnicity: Levels of TV viewing are typically higher in 'non-white' ethnic groups, eg, African-American.

Social/cultural factors

- Parental behaviours and practices: Young people tend to have higher levels of sedentary behaviour if their parents or siblings also engage in high levels of sedentary behaviour.
- Accessibility: Having more television sets or computers within the home and having a TV in the bedroom is also associated with higher usage.
- Rules: Parental rules regarding TV and computer use are associated with lower levels of participation in these behaviours for young people.

There is currently no evidence on environmental factors and associations with sedentary behaviour in children and young people.

Public health guidelines

Public health guidelines for sedentary behaviour are a relatively new development. In July 2011 the UK joined Australia and Canada (among others) in providing public health guidelines aimed specifically at highlighting the potential health risks associated with sedentary behaviour and encouraging people of all ages to limit their participation in these behaviours⁽³⁾.

For each age group addressed in the current public health guidelines (early years, children and young people, adults and older adults), it is recommended they: ***“should minimise the amount of time spent being sedentary (sitting) for extended periods”***.

This guideline reflects the growing body of evidence indicating sedentary behaviour may be adversely associated with various physical and psychological health outcomes. However, this remains a relatively new field of research, and unlike guidelines provided for physical activity, it is not yet possible to provide a quantitative recommendation to indicate a duration

of sedentary time above which health may be at risk, eg, two hours/day. As the evidence continues to accumulate, it may become possible to refine this guideline and provide more precise recommendations.

The current public health guideline is intentionally global in its scope, recommending that people of all ages limit their sedentary time without specific reference to a particular type of sedentary behaviour, eg, TV viewing, or context, eg, leisure-time, school or occupation. This is because it is not currently known whether different types of sedentary behaviour, or the different contexts in which the behaviour takes place, may be differentially associated with health. Much of the existing evidence is based upon TV viewing and computer use accumulated during leisure-time, but research exploring other behaviours in other contexts is emerging and will help to refine future public health recommendations. Based upon the current guideline it is recommended efforts are directed towards a general reduction in sedentary behaviour and breaking up periods of prolonged sitting.



Interventions to reduce sedentary behaviour

The growth in evidence linking sedentary behaviour with physical and psychological health outcomes has led to an increasing number of interventions aimed at reducing sedentary behaviour in both adults⁽³³⁾ and children and young people^(34, 35).

Adults

Relatively few intervention studies have been conducted to reduce sedentary behaviour in adults. A recent review examined the effectiveness of workplace interventions to reduce sitting time⁽³³⁾. Only six studies were identified for the review, and none were found to be effective in reducing sitting time. One possible explanation for this lack of effectiveness is all reviewed studies were principally concerned with increasing physical activity; reducing sedentary behaviour was included only as a secondary outcome. The correlates of sedentary behaviour are likely to be different from those of physical activity, and as such, it is unsurprising that no changes in sedentary behaviour were observed. In addition, all studies used self-report methods for measuring sedentary behaviour which may not be sufficiently sensitive to detect changes in this behaviour.

Children and young people

Recent reviews have examined the effectiveness of interventions aimed at reducing sedentary behaviour in children and young people^(34, 35). Studies included in these reviews focused exclusively upon reducing screen-based sedentary behaviours, eg, TV viewing, computer use, and the majority were conducted outside the UK. Interventions to reduce sitting in young people have generally been effective, but changes in behaviour have been relatively small. There is limited information on what characterises effective interventions in terms of intervention content and key target groups. There is some evidence that interventions including family/parental involvement are likely to produce greater changes in sedentary behaviour. This is consistent with correlates research indicating the family and home level factors are a key

influence on sedentary behaviours in young people.

Reducing sedentary behaviour - how is time re-allocated?

A key consideration in evaluating interventions to reduce sedentary behaviour is how time is re-allocated if a change in the targeted behaviour is achieved. For example, if an intervention successfully produces a 20 minute reduction in TV viewing it is important to know how that time is re-allocated. If time is simply shifted from one form of sedentary behaviour to another, as has been shown in some studies⁽³⁶⁾, there may be no net benefit for health. For this reason, evaluation of sedentary behaviour interventions should use methods that assess total sedentary time and time spent in a wide range of sedentary behaviours.

Summary

- The evidence base on effective methods for reducing sedentary behaviour is currently very small, and there is little information on which to base recommendations for particular intervention methods or strategies.
- Drawing upon both the correlates and intervention literature, it appears interventions targeting the whole family, including parents and siblings, may be an effective method of reducing screen-based sedentary behaviours in children and early adolescents.
- The development and evaluation of interventions aimed at reducing sedentary behaviour in children and adults is a priority.
- In children and young people, there is a need for studies that target behaviours other than screen-based media and in domains other than leisure-time, such as school or transport.
- In adults, interventions targeting transport and leisure-time sedentary behaviour are required, as well as prolonged sitting in the workplace.
- In studies with adults and children and young people, objective methods of measuring sedentary time should be used wherever possible.



Implications for practice

The evidence summarised in this document has important implications for commissioners, policy-makers and practitioners. Potential action areas for each of these groups are outlined below. Strategies to reduce sedentary behaviour should be implemented alongside those aimed at increasing participation in physical activity.

Actions for commissioners

- Consider commissioning interventions which focus on reducing sedentary behaviour.
- Commission programmes aimed at reducing sedentary behaviour in adults for whom there is consistent evidence that sedentary behaviour is associated with increased risk of certain diseases and conditions. Give particular consideration to settings (eg, workplace) and age groups (eg, older adults) where there is greatest potential to reach high numbers of people who are sedentary for extended periods of time.
- Consider commissioning family and home-level interventions as they appear to be effective in reducing screen-based sedentary behaviours in children and young people.
- Ensure that robust monitoring and evaluation is built into local programmes to help develop the evidence base on effective interventions to reduce sedentary behaviour.

Actions for policy makers

- Policy-makers from various disciplines, including health, education, welfare, occupational health and social development, should be aware of the importance of reducing sedentary behaviours.
- Action should be taken to reduce the potential health risks associated with sedentary behaviour through policy measures.
- Sedentary behaviour reduction should be a standard policy item in guidance documents on health.
- Assess in advance what impact (both intended and unintended) any policy proposals are likely to have on sedentary behaviour.
- Provide educational opportunities on sedentary behaviour for different professional groups who can help reduce this behaviour.
- Policy makers should support and encourage employers to take steps to minimise sedentary behaviours in employees, including regular breaks from sitting at a computer.
- Policy makers should support and encourage schools to consider how they can reduce extended periods of sitting for pupils.

Actions for practitioners

- Practitioners working in various disciplines, including primary care, welfare, education and occupational health, should review their knowledge and understanding of the health risks associated with sedentary behaviour.
- Action should be taken to minimise risk in the practitioner's target audience.
- All age groups (children, younger people, adults and older adults) should be educated on the potential health risks of sedentary behaviour and be provided with strategies they can adopt to break up their sedentary time.
- Regular active breaks should be encouraged during work and school time.
- During leisure-time, active breaks should focus upon times of day when sedentary behaviours are most likely to occur, such as after school or work, evenings, weekends and during holidays.
- Practitioners should promote and help develop strategies which encourage families to set rules or 'quotas' on screen-time and remove TVs or video game machines from bedrooms.
- Practitioners working with parents/carers should encourage them to limit the amount of time young children are restrained in highchairs, pushchairs or car seats.
- Practitioners should encourage parents to be good role models by reducing personal sedentary behaviour.
- Practitioners should implement robust monitoring and evaluation of local programmes.

References

1. Brown WJ, Bauman AE, Owen N. Stand up, sit down, keep moving: Turning circles in physical activity research? *Br J Sports Med*. 2009 02;43(1473-0480; 0306-3674; 2):86-8.
2. Katzmarzyk PT, Mason C. The physical activity transition. *J Phys Act Health*. 2009 05;6(1543-3080; 1543-3080; 3):269-80.
3. The Department of Health. Start active, stay active: a report on physical activity for health from the four home countries' Chief Medical Officers. 2011.
4. Pate RR, O'Neill JR, Lobelo F. The Evolving Definition of "Sedentary". *Exerc Sport Sci Rev*. 2008 10;36(4):173-8.
5. Tremblay MS, Colley RC, Saunders TJ, Healy GN, Owen N. Physiological and health implications of a sedentary lifestyle. *Appl Physiol Nutr Metab*. 2010 12;35(1715-5312; 6):725-40.
6. Proper KI, Singh AS, van Mechelen W, Chinapaw MJ. Sedentary behaviors and health outcomes among adults: a systematic review of prospective studies. *Am J Prev Med*. 2011;40(2):174-82.
7. Grontved A, Hu FB. Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality: A Meta-analysis. *JAMA*. 2011 06/15;305(1538-3598; 0098-7484; 23):2448-55.
8. Chinapaw MJ, Proper KI, Brug J, Van MW, Singh AS. Relationship between young peoples' sedentary behaviour and biomedical health indicators: a systematic review of prospective studies. *Obes Rev*. 2011 07;12(1467-789; 1467-7881; 7):e621-32.
9. Thorp AA, Owen N, Neuhaus M, Dunstan DW. Sedentary behaviors and subsequent health outcomes in adults: a systematic review of longitudinal studies, 1996-2011. *Am J Prev Med*. 2011 08;41(1873-2607; 0749-3797; 2):207-15.
10. Boyle T, Fritschi L, Heyworth J, Bull F. Longterm sedentary work and the risk of subsite-specific colorectal cancer. *Am J Epidemiol*. 2011 05/15;173(1476-6256; 0002-9262; 10):1183-91.
11. Hamer M, Stamatakis E, Mishra GD. Television- and Screen-Based Activity and Mental Well-Being in Adults. *Am J Prev Med*. 2010 04;38(4):375-80.
12. Teychenne M, Ball K, Salmon J. Sedentary behavior and depression among adults: a review. *Int J Behav Med*. 2010 12;17(1532-7558; 1070-5503; 4):246-54.
13. Marshall SJ, Biddle SJ, Gorely T, Cameron N, Murdey I. Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. *Int J Obes Relat Metab Disord*. 2004 10;28(0307-0565; 0307-0565; 10):1238-46.
14. Pearson N, Biddle SJH. Sedentary behavior and dietary intake in children, adolescents, and adults. A systematic review. *Am J Prev Med*. 2011;41(2):178-88.
15. Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, et al. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *Int J Behav Nutr Phys Act*. 2011;8(98).
16. Biddle SJH, Pearson N, Ross GM, Braithwaite R. Tracking of sedentary behaviours of young people: a systematic review. *Prev Med*. 2010;51:345-51.
17. Health Survey for England 2008. Volume 1: Physical activity and fitness. Leeds: The NHS Information Centre for health and social care; 2009.
18. Stamatakis E, Hillsdon M, Mishra G, Hamer M, Marmot M. Television viewing and other screen-based entertainment in relation to multiple socioeconomic status indicators and area deprivation: The Scottish Health Survey 2003. *J Epidemiol Community Health*. 2009 09;63(1470-2738; 0143-005; 9):734-40.
19. World Health Organization. Young people's health in Great Britain and Ireland. Findings from the Health Behaviour in School-Aged Children Survey 2006. 2009.
20. Growing up in Scotland: Year 2. Results from the second year of a study following the lives of Scotland's children. Edinburgh: The Scottish Government; 2008.
21. HBSC Scotland National Report. Health behaviour in school aged children: World Health Organization collaborative cross-national study (HBSC). Findings from the 2010 HBSC Survey in Scotland. 2011.
22. Health Behaviour in School-Aged Children: Initial findings from the 2009/10 survey in Wales. Ipsos MORI Social Research Institute; 2011.



23. Northern Ireland Statistics & Research agency. Young Persons' Behaviour & Attitudes Survey 2010: Top-Line Results. Belfast: Central Survey Unit; 2011.
24. Bauman AE, Sallis JF, Dzawaltowski DA, Owen N. Toward a Better Understanding of the Influences on Physical Activity: The Role of Determinants, Correlates, Causal Variables, Mediators, Moderators, and Confounders. *Am J Prev Med.* 2002 08;23(0749-3797; 0749-3797; 2):5-14.
25. Matthews CE, Chen KY, Freedson PS, Buchowski MS, Beech BM, Pate RR, et al. Amount of Time Spent in Sedentary Behaviors in the United States, 2003-2004. *Am J Epidemiol.* 2008 04/01;167(7):875-81.
26. Marshall SJ, Ramirez E. Reducing Sedentary Behavior: A New Paradigm in Physical Activity Promotion. *Am J Lifestyle Med.* 2011;DOI: 10.1177/1559827610395487.
27. Gorely T, Marshall SJ, Biddle SJ. Couch kids: Correlates of television viewing among youth. *Int J Behav Med.* 2004;11(1070-5503; 1070-5503; 3):152-63.
28. Hinkley T, Salmon J, Okely AD, Trost SG. Correlates of sedentary behaviours in preschool children: A review. *Int J Behav Nutr Phys Act.* 2010;7(1479-5868; 1479-5868):66.
29. Cillero IH, Jago R. Systematic review of correlates of screen-viewing among young children. *Prev Med.* 2010 07;51(1096-0260; 0091-7435; 1):3-10.
30. van der Horst K, Paw MJ, Twisk JW, Van MW. A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc.* 2007 08;39(0195-9131; 0195-9131; 8):1241-50.
31. Pate RR, Mitchell JA, Byun W, Dowda M. Sedentary behaviour in youth. *Br J Sports Med.* 2011;45:906-13.
32. Salmon J, Tremblay MS, Marshall SJ, Hume C. Health Risks, Correlates, and Interventions to Reduce Sedentary Behavior in Young People. *Am J Prev Med.* 2011;41(2):197-206.
33. Chau JY, der Ploeg HP, van Uffelen JG, Wong J, Riphagen I, Healy GN, et al. Are workplace interventions to reduce sitting effective? A systematic review. *Prev Med.* 2010 08/27(1096-0260; 0091-7435).
34. Biddle SJH, O'Connell S, R B. Sedentary behaviour interventions in young people: a meta analysis. *Br J Sports Med.* 2011;In Press.
35. Maniccia DM, Davison KK, Marshall SJ, Manganello JA, Dennison BA. A Meta-analysis of Interventions That Target Children's Screen Time for Reduction. *Pediatrics.* 2011 07;128(1098-4275; 0031-4005; 1):e193-210.
36. Epstein LH, Saelens BE, O'Brien JG. Effects of reinforcing increases in active behavior versus decreases in sedentary behavior for obese children. *Int J Behav Med.* 1995;2(1070-5503; 1070-5503; 1):41-50.

Keep up-to-date

Our bi-monthly updates bring the latest developments in physical activity and health straight to your inbox and feature all the latest resources and publications, funding opportunities, conferences, events and much more.

Sign-up to our database - It's FREE!

To receive our bi-monthly physical activity update and information about other resources like this evidence briefing subscribe to the free BHFNC database at www.bhfactive.org.uk/subscribe-to-database

Follow us on Twitter

You can also keep up-to-date on the latest news by following us on Twitter. Follow us on @BHFactive

Got a burning question?

Do you have a physical activity query you need an answer to? Our helpline may be able to help. Get in touch on **01509 226421** or email bhfnc@lboro.ac.uk

Last updated April 2012